Cement MILL SECTION of

Concrete

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The Causes of Discoloration of Clinker

Cement Plant Operators Express Opinions That Quenching Hot Clinker and Deficiency of Air in Burning Offset Color of Clinker and Cement

A condition experienced in the past at a large modern cement plant resulted in the discoloration of the clinker produced. It had always been customary in the past to run the hot McCaslin clinker conveyor through water and when the clinker had reached the top of the tower and immediately before dumping, a stream of water was allowed to run on the hot clinker. As the majority of the buckets were split, quite a little water leaked through into the hot clinker from the tunnel. For three weeks after starting up, the clinker was normal in color and then apparently for no reason and with exactly the same conditions obtaining, the clinker became discolored.

It was found that the water was badly discoloring the clinker, to the extent that it was noticeable in the pats. The clinker was turned a light brown and also seemed very difficult to grind. The raw materials used were exactly the same and a chemical analysis of the air-cooled and water-cooled clinkers revealed nothing except a higher loss on ignition on the water-cooled sample.

The water level in the hot clinker tunnel was lowered and then by the time the hot clinker had reached the storage, a small stream of water was allowed to spray on it with no discoloration taking place. It was apparent that the clinker had to cool off a certain amount before water could be added with safety in order to avoid discoloration.

Before lowering the water level in the hot clinker tunnel, the buckets had been well submerged. Naturally enough, too, the superintendent stated, a large number of the buckets were split, thereby allowing water to come in contact with the hot clinker, and it was the clinker in the bottom of the buckets which showed the discoloration, the amount depending upon the depth of the split in the buckets.

The difficulty outlined had never been experienced at this mill in five years of operation, nor in any other mill with which the inquirer had been chemist. The condition could not be attributed to dirty coal, as for three weeks after starting operations the clinker had been normal in color as stated above. The coal used was a part of a shipment of 5,000 tons from the same mine and all of practically the same composition.

Hot clinker taken immediately on leaving the kiln and placed under a jet of cold water acted in precisely the same way. The principal difficulty with which the mill was faced was that the hot clinker was harder to grind than when it was suddenly cooled by the addition of water.

It was finally suggested that this condition of discoloration might be brought about by the use of insufficient air at the front end of the kiln. This opinion by the operator was confirmed when it was found that by speeding up the fans, thus forcing more air into the firing end of the kilns, the trouble was eliminated.

Various opinions on the subject have been formed by chemists, superintendents and cement plant engineers, based upon their personal experiences or observations, some of which are outlined in the following paragraphs.

Analysis for Ferrous Iron

The fact that normal clinker would turn yellow if suddenly quenched in cold water while hot has been known for a long time, one engineer of wide experience stated upon having the conditions outlined to him and seeing samples of the black and yellow clinkers. All clinker will show this phenomenon and it is further cited that it may be seen in another way when a sample of the clinker falling from the end of the kiln is caught on a cold shovel. The fine particles will be cooled quickly enough by the shovel to take the same yellow color.

This writer states that no trouble had ever been experienced by him from this source in mill operation, but just as an experiment some years ago some clinker had been quenched in a pail of water and cement was made from the resulting yellow product. Like in the case outlined above, it was found that the strength of the product was unaffected, but the cement had an undesirable yellow color.

It is further stated that so far as this engineer knows, no study of the cause of this change of color has been made. It is very evident to him that the sudden cooling makes fixed in the clinker some chemical of physical condition that will alter if the clinker cools slowly and time is given for the change. It was suggested that it might be that the iron in the white hot clinker in the kiln was in the ferrous condition and that it oxidized to the ferric state during slow cooling, but that this oxidation was prevented by sudden cooling to a temperature below that at which oxidation can take place.

The possibility is suggested that one or more of the crystalline compounds existing in white hot clinker are not stable at lower temperatures, and change either their composition or crystal form if given time to do this by slow cooling, but are not sufficiently unstable to change spontaneously at ordinary temperatures, as this would result in dusting.

"A very similar state of affairs occurs during the tempering of steel. Here a structure that is not stable at ordinary temperature is fixed by cooling below the point where a rearrangement to the stable form can take place. On the other hand, the devitrification of glass is an instance of crystallization from an undifferentiated magma by holding it a sufficient length of time at a suitable temperature.

"The burning of cement clinker consists of partially fusing the raw mix to a semi-molten magma from which new compounds crystallize as the magma cools. It may be that crystallization is not complete when the clinker falls from the kiln, but will go on to completion if time enough is given by slow cooling, while quenching may make permanent the existence of a large amount of glassy ground-mass that has not had time to crystallize.

"Of course the foregoing is conjecture and reasoning based on analogy to the behavior of other substances. The solution of the problem would probably make a very pretty petrographic study in this section of the two kinds of clinker taken from the same kiln at the same time."

To further check up on the suggestion that possibly the iron in the quenched clinker might be in a ferrous condition which would account for the light color, the engineer quoted above analyzed for ferrous iron two samples of clinker from the plant mentioned by the original inquirer, and could find no difference between them and practically no ferrous iron in either, although one was of the yellow clinker and the other of the normal colored clinker.

He then quenched some clinker from one of the kilns at the plant which he was operating and at the same time permitted a portion to cool slowly. The local clinker showed the same phenomenon of turning yellow on sudden cooling. Analysis of these two samples showed no ferrous iron in either one.

That the exact analysis for ferrous iron in silicates is not easy is cited, and this will probably be admitted by anyone who will take the trouble to look the matter up. Reference is made to the Geological Survey Bulletin No. 700—*The Analysis of Silicate and Carbonate Rocks,* by W. F. Hillebrand. These tests are stated to indicate that the state of oxidation of the iron in clinker is not responsible for the yellow color assumed by the clinker on quenching or sudden cooling.

White Cement Clinker

Richard K. Meade states that it has long been known that cement clinker if quenched suddenly while hot would have its color very materially changed. In the second edition of his book on "Portland Cement," Meade states as follows:

"The writer has frequently cooled clinker suddenly by plunging it, red hot from the mouth of the kilns, into water. The only perceptible effect is to bleach the color from dark greenish black to nearly white. If this clinker is dried and ground, it will be found to have pretty much the same properties as clinker caught at the same time and allowed to cool slowly in air. The writer has never observed that unsound cement could be made sound by this process. It does take up some water (probably on the outside of the lumps only, however), as a loss on ignition test will show. Such clinker is easily ground and the resulting cement trowels nicely."

The same writer points out that it is the general practice to quench white portland cement clinger, as that improves the color and makes the clinker white instead of light green.

Some Opposing Conclusions

Some experiments conducted along the lines previously referred to have been conducted at a plant on the West Coast and the results reported seem to be opposite to the ones previously stated. Some of the conclusions drawn in this case are:

1. Quenching clinkers above a red hot heat with water does not alter the color of the clinkers, neither does it make them any tougher to grind, if they are dried at once and ground, but the increase in moisture which such quenched clinkers will gain, if not dried out, may make them harder to grind.
2. Quenched clinker shows a greater strength in the 24-hour neat cement tests, a greater hydration of its constituents and lighter colored briquettes. The lighter color is probably due to the greater hydration removing more water from the surface of the briquettes, as dry mortar is lighter than wet mortar.

It is the stated practice of some of the cement plants on the West Coast to add water to clinkers while they are still red hot, without any discoloration resulting. Oil or a reducing agent, if added to hot clinkers, and the clinkers allowed to cool without further heating, causes them to be a red to brown color on the surface. If the clinkers did have oil or other reducing agents contaminating them from the burners, such clinkers if quenched would be more liable to show discoloration than clinkers which cooled slowly and were allowed to oxidize.

The further conclusion is added by the latter writer that a deficiency of air in burning would affect the color only in that it would have a tendency to cause underburning, and in cases of localized segregation of its constituents, such as the small green areas of ferrous silicates, which are quite common where the raw materials contain coarse silica.

Charges Discriminatory Cement Rates

Missouri Portland Cement Co. has filed complaint with Missouri Public Service Committee against Missouri Pacific, 'Frisco, Burlington, Atchison, Terminal Association of St. Louis, and other railroads, alleging that they are charging discriminatory rates against it on shipments of cement. Appointment of a commission to investigate complaint is asked.—*Wall Street Journal.*

A shipment of 300 tons of cement from California for the new St. Helens Pulp & Paper Company arrived at St. Helens, Oregon, recently, on the steam schooner, Silverado. After discharging the building material, the vessel went on to Portland to unload miscellaneous cargo.

The new paper mill is being built by the McCormick and Hawley interests.

When completed, the plant will likely furnish considerable print paper for shipment to California ports on coastwise vessels.

Sidelines for Cement Manufacturers

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The following article written after a survey of the possibilities in England may contain some food for thought for American cement manufacturers, although the course followed in producing markets for portland cement in this country differs in many respects from that followed in England. The tendency in the United States has been to direct efforts, both individual and collective, toward the production of better quality cements and to educate consumers of cement in its use in concrete, rather than to enter directly the field of concrete products.

Although the latter course might provide an outlet for a small percentage of the cement produced and, at the same time, give employment to a few workmen during the slack periods, it is a question as to whether the effort could not be better spent in continuing the studies of means for producing better concrete with the cements now being produced.—*Editors.*

It may be interesting and useful to call attention to a few much wanted articles which should be regarded in the light of sidelines by manufacturers of cement. The writer is quite aware, of course, that cement manufacturers, as a rule, do not go in very extensively for sidelines of any kind, and as is natural their interests are entirely centered upon the production of more and better cement. This article, however, is intended as a practical contribution to the subject, and it is hoped that it will open up a little new line of thought, and further than this a source of additional profit. It is folly, of course, attempting to develop sidelines in cement manufacture unless there is a good prospect of disposing of the manufactured articles at a satisfactory price.

Concrete Bricks for Building Construction

The first sideline suggested is the concrete brick of which such extensive use might be made in building construction if it were only cheaper and easier to obtain. It is absurd to allow building contractors to make their own concrete bricks for house building, as they do now, when obviously these bricks could be manufactured in quantity at probably a quarter of what they now cost.

While individual building contractors find in certain districts that it pays them better to make their own concrete bricks than either to buy ready made concrete bricks or clay bricks, the time will surely come when the clay brick and quarried stone will find exceptionally small application in building construction. The concrete brick is economical. It can be made with very little cement, in some cases less than one-tenth of its total bulk, and further the aggregate may consist of all manner of waste materials which, as a rule, are actually given away. Then again concrete bricks do not require burning, while for hardness and denseness they are quite equal to the very best clay bricks on the market, and in some cases ten or a hundred times better.

The concrete brick sideline could, therefore, be developed by cement manufacturers whose factories are in or near growing towns. Waste heat from the cement burning kilns themselves can actually be used in curing the bricks, and the manufacture speeded up in many ways by the introduction of the very latest pressing and mixing devices. Where exceptionally hard slag wastes are employed in the manufacture of concrete bricks crushers will be required, but the chips and dust resulting from this operation instead of being wasted can be utilized in place of sand in the manufacture of the bricks.

Copings, Flags, and Setts for Highway Work

Another sideline which cement manufacturers could certainly develop is the preparation of coping stones, flags, tramway and other paving setts and drain gully bricks, all of which find wide application in highway work. While in some cases as much as a fifth of the total bulk may have to be of cement, in most instances a tenth of the total volume will again be ample. Aggregate for the formation of the copings, etc., should be again obtained where possible from waste materials.

Town destructor slag is an excellent material for the manufacture of coping stones and flagstones, as a few concrete constructional engineers have already realized. Blast furnace slag can be pressed into service as the raw material for the formation of the setts and bricks, suitable slag sand being mixed with the cement before the addition of the coarser material.

Examination of copings, flagstones, and setts manufactured from cement and waste materials some years ago has shown that they stand the weather well, and are by no means readily worn away by traffic, however heavy it may be. Tests such as those mentioned are useful, and if the day comes for flagged roads as it may do, cement manufacturers should at once develop the sideline, and see that large supplies are immediately available.

Ready Mixed Concrete: A Much Wanted Material

Another sideline which cement manufacturers might very well develop is the sale of ready mixed concrete. Small users of cement would buy this in relatively large amounts, as, of course, it saves them trouble. Aggregate is by no means easy to get universally, but if it were already in the mixture and the concrete only required moistening with water it would prove exceptionally convenient. The measuring of the correct quantities of cement, sand, and stone, is not always properly done on a small scale, and very often the cement is blamed, owing to incorrect proportions having been used. If the cement manufacturer sells ready mixed concrete, however, he is sure that a good setting material will be obtained, which will give universal satisfaction. Once buyers are introduced to ready mixed concrete it should find a ready market, and considering the up-to-date mixing appliances which are available the cost should be low.

Obviously if ready mixed concrete were supplied in sacks, directions would have to be printed thereon warning users that the fine material might become segregated, or if very heavy stone were used this might sink to the bottom of the sack and the dust remain on the top. Such concrete would have to be re-mixed when the sack was emptied, but in view of the fact that the proportions are correct no measuring would be necessary.

The writer is surprised that cement manufacturers in

England have not developed as a sideline the preparation of rough burrs for the formation of the under surfaces of roads. Such road metal could be manufactured very extensively for practically nothing, and would save highway engineers the cost of purchasing quarried stone in a great many instances.

In the preparation of this material very coarse stone or slag is essential, as well as abundant supplies of sand.

As a rule only about a tenth of the total volume need be cement, provided that thorough mechanical mixing is undertaken, and the materials properly wetted. After proper mixing the material is allowed to set for a period extending from one day to a week, to form hard solid blocks. These are broken up by compressed air drills into large pieces, and the pieces are passed through crushers to reduce them to any desired size. The small material is used for the surfaces of roads, for which it will prove satisfactory either tarred or as it is, while the fine material may be returned to the mixer for use instead of sand in the preparation of a further consignment of the burrs.

All kinds of slaggy trades wastes can be utilized in the preparation of these rough road burrs, and cement manufacturers could obtain the wastes in their own districts, and if necessary arrange for the delivery of shipments of similar materials from other more distant centers where no use can be made of them.

Lubrication of Cement Mill Machinery

The Unusual Conditions Met with in Handling and Crushing Rock Require Careful Study in Order That the Equipment May Be Kept in Efficient Operation by Proper Lubrication

That the lubrication of the machinery used in the cement, lime, and rock products industries in general depends upon several factors is the conclusion drawn in an article in *Lubrication*, issued by The Texas Company. The lubrication of such equipment is summarized as a matter of—

1. Using clean, properly refined lubricants.
2. Designing wearing surfaces and lubricators as nearly oil tight and dust proof as possible.
3. Changing lubricants at frequent intervals.
4. Maintaining all parts to be lubricated as clean and free from foreign matter as is consistent with operating conditions.

It is further concluded that rough conditions should not be accepted as inevitable. Nor should the matter of lubrication and lubricants be regarded in too casual a manner. It is the best and most decided means of keeping machinery operating and increasing production.

It is pointed out that the rock products industry is distinctive for the magnitude of its output, the size and capacity of the machinery involved and the extensive field it covers. Essentially the article is concerned with the operation and lubrication of the machinery involved. To serve the predominating prime movers—steam and electricity, and the combustion engine, together with the other miscellaneous equipment involved such as crushers, steam shovels, excavators, etc., requires approximately 12,230,000 gallons of oil and 12,120,000 pounds of grease per year.

Excavating Equipment

The essential equipment in practically every rock products recovery from the quarry or pit is the power shovel operated by one of the prime movers mentioned in the foregoing — the steam shovel predominating. These power shovels are usually built along two designs according to the class of service they are used for. The dragline excavator is the other type used in cases where the materials respond comparatively readily to the action of the bucket or scoop.

According to the nature and ultimate use which is to be made of the product from the excavator, it is either conveyed to the crushing mill for further refinement, or if it is to be used in the raw state, it may be loaded directly to the shipping cars. The immediate conveyors which operate between the quarry or pit and the mill in general comprise industrial rail cars, motor trucks or tractor drawn carriers.

Crushers and Breakers

The first treatment which rock or stone receives is a certain amount of crushing or breaking, dependent on the ultimate product desired. As a rule this product may be subdivided into two classifications, (1) preliminary and (2) finishing. Preliminary crushing constitutes the breaking up of the product into a sufficient state of fineness to render it suitable for final grinding or pulverization. For this purpose jaw crushers, gyratories or single roll crushers are used.

Gyratories are especially adapted to cement mill work for the reduction of rock to the proper size for pulverization. At the bottom of the shaft of the gyratory provision is made for lubrication of the driving eccentric mechanism. This can be admirably brought about by providing for bath or pressure lubrication from a reservoir of oil located below the bottom of the shaft.

Other refining equipment, the lubrication of which is important, includes hammer mills and pulverizers such as ball and tube mills.

Screens

Following the process of crushing and pulverization, whatever the product involved, it must usually be subjected to a certain amount of screening to segregate the particles according to their size and fineness. In the cement mill, it is absolutely essential to screen out all coarser particles of stone, for the fines must run uniform in size.

Lubrication—Steam Cylinders

In order to keep power shovels, scrapers and other excavating machines in continuous operation, it is decidedly essential to give every care to their lubrication at all times.

In the steam driven machine, perhaps the most important detail is the lubrication of steam cylinders. In the operation of practically any type of excavating machine, which may be steam driven, the existing conditions will be such that if any but a high grade, properly compounded lubricant is used, the cylinders will suffer accordingly.

As a general rule, the steam used on these machines will be of comparatively low pressure (ranging from 100 to 160 pounds). As a result it may have quite an extensive moisture content. For although it is usually taken from the highest part of the boiler, it will frequently be relatively wet when it enters the header. Furthermore, line condensation between the boiler and the engine will be high with a corresponding decrease in pressure, due to the fact that the steam pipes are often not covered to any great extent and the engines are frequently subject to intermittent operation. As a result there will almost always be an accumulation of water above the throttle valve prior to starting the engine, depending in amount upon the length of time it has been stopped. Now, if the cylinders are not covered with a tenacious film of properly compounded lubricant, the admission of these slugs of water will tend to wash the lubricant from the wearing surfaces, and for the next few strokes insufficient lubrication will be possible and scoring and abnormal wear may occur. The constant repetition of the above will not take long to induce frictional losses, and inefficient operation of the entire machine due to steam leakage past the piston rings. Groaning of the engine or chattering of the valves on their seats may also occur under extreme conditions.

As a result the problem is to select and use a grade of steam cylinder oil which contains a sufficient amount of high grade animal or fixed oil to promote the formation of an extremely adhesive film of emulsified lubricant, which will adequately resist the washing action of any water that may be present. To insure the best results the base of this lubricant should be a medium viscosity, highly adhesive steam cylinder stock. For this purpose a comparatively high compound cylinder oil ranging in the neighborhood of 130 seconds Saybolt viscosity at 210 degrees F. will in general meet the variable requirements involved.

It is not enough, however, to choose the proper grade of oil. The means of application is also of importance. In order to efficiently lubricate engines under such conditions the oil should be delivered by a positive feed lubricator via suitable atomizers. It is possible to use either hydrostatic lubricators or mechanical devices for this purpose.

The location of the oil pipes and atomizers in the steam lines is also important. These points should be approximately from 4 to 6 ft. back from the throttle valves. In cases where a steam thrusting engine is located on the boom in certain types of these machines, the oil line often enters the steam pipe much farther away from the throttle, with the result that in event of a steam leak at the ball or swing joint there will be considerable loss of oil as well, with in all probability insufficient oil lubrication just as long as this leakage is allowed to continue.

General Lubrication Including Motor Bearings

In the average excavating machine which is used for the recovery of rock products from the earth, general lubrication may be regarded as covering the external wearing parts of the engines, bearings, and in fact all else but gears, chains and wire rope.

On excavating machines which are equipped with caterpillar tractors the lubrication of link-pin and rollers is often an important item. The object is to insure against excessive friction losses and power consumption.

Automatic lubrication is generally regarded as most satisfactory, the lubricant being furnished from internal reservoirs located in the treads and rollers. For this service the engine oil mentioned below will in general meet the requirements.

On certain types of shovels and other excavating machinery, journal boxes akin to those used in railway service may be installed on traction wheel journals. As a result the latter, although they are not subjected to the same high speeds and lengthy periods of operation as are prevalent in the railroad service, are lubricated in a similar manner by packing the journal box with wool waste which has been saturated with mineral oil.

As a rule other wearing parts on the average excavating machine can be taken care of by means of a medium viscosity straight mineral oil ranging from 300 to 500 seconds Saybolt viscosity at 100 degrees F. or by a high grade cup grease. Many builders equip their machines for grease lubrication. The product used for the purpose should be free from acid or alkali and should contain no filler such as talc or asbestos which would tend to clog the oil-ways.

In order to insure more positive lubrication of parts such as the block on the lower tension cable on certain types of excavators, the builders have installed ball bearings. As a result the necessity of the operator climbing up to re-lubricate at periodic intervals is eliminated and the operation of the bucket has been found to be improved.

Engine bearings and other parts which are to be lubricated with oil can generally be operated on a 300 to 500 seconds viscosity straight mineral lubricant as has already been stated. For motor bearings, however, as are involved in electric driven machines, a lighter oil will in all probability give better results; as a rule, ring oiling systems are installed on the motor. This oil should range from 180 to 200 seconds viscosity.

In addition, there are many parts on every excavating machine which will frequently require hand oiling. This is not recommended, however, due to the possibility of oil holes becoming clogged with dust and dirt and the bearings suffering accordingly. It has been proven that sight feed oil cups will give very much better results. They should at all times be covered, however, so that the contents will be kept free from entry or contaminating foreign matter.

Internal Combustion Engines

Where power shovels and scrapers are operated by oil, kerosene or gasoline engines instead of steam or electric power, lubrication develops into a problem akin to that involved in the modern automobile, tractor or oil engine.

For such service the engine oil is of chief importance and it should be given careful consideration, taking into account the operating conditions involved and the requirements imposed on the oil. As a rule some form of circulating lubricating system will be involved, the oil passing either through a hollow crankshaft under adequate pressure to reach all wearing parts or being splashed by the connecting rods, etc. On oil and gasoline engines a straight mineral engine oil from 300 to 750 seconds Saybolt viscosity at 100 degrees F. will be appreciable, the grade selected being dependent upon the weather and operating temperatures. For tractor plant engines a somewhat heavier lubricant should be used.

Gears, Chains and Wire Rope

Other wearing parts which also will in all probability present lubricating problems on the average excavating machinery are the gears, chains and wire rope. In order to insure the preservation of this equipment and maintain operation at the highest state of efficiency, it is essential at all times to keep these parts well coated with a suitable compound which will serve not only as a lubricant but as a preservative. Wire rope in particular requires attention due to the possible hazard involved if internal strands are allowed to rust, wear and corrode. Although wire rope as constructed today contains a hempen core which is usually soaked in lubricant prior to the winding of the steel strands, the theory that this core will serve to adequately lubricate the strands and to prevent wear, rust and corrosion during subsequent operation should not be relied upon. Therefor the external surface of the rope should be treated at frequent intervals with a suitable lubricant and preservative which is capable of penetrating to the innermost strands during operation, not only re-lubricating the core but as well preventing wear at the points of contact of the strands.

In order for a lubricant to adequately meet these conditions it must be—

1. Capable of being readily applied in a thin uniform film without undue heating.
2. Free from acid and alkali.
3. Plastic at all temperatures.
4. Non-evaporating.
5. Non-hardening.
6. Insoluble and resistant to water.
7. Capable of resisting the entry of dust, dirt and other foreign matter.
8. Adhesive and tenacious enough to insure that it will not run off or drip under abnormal pressures or temperatures.

The most generally suitable lubricant to meet these conditions is a pure petroleum product having a viscosity of from 1000 to 2000 seconds Saybolt at 210 degrees F. This lubricant is also applicable to gears and chains on the average rock products excavating machine.

Whatever the type of machine involved, the setting and aligning of gears is important and all these should so mesh that there will be a uniform and constant application of power with smooth, quiet operation in order to insure against jerky action of the parts which they operate. The occurrence of this latter would tend to produce strains and abnormal wear, not only on the gears, but also on other driving mechanisms. To attain the best results in applying the gear lubricant the surfaces of all teeth should first be washed with kerosene or some other solvent, the lubricant then being heated and brushed or poured lightly onto the wearing surfaces while the gears are in slow rotation. Pressure between the teeth will adequately spread the lubricant if it is applied in the proper amount, and it should not be forced over the sides of the gears unless the film is too thick. In this event the intensity of the application should be decreased.

Jaw Crushers and Breakers

Lubrication of jaw crushers and breakers is essentially confined to the bearings of the pitman or heavy steel casting which oscillates with its bearing as the point of suspension to bring about the requisite degree of crushing. As a rule the pitman bearing is water cooled; in addition, in certain larger crushers it is relieved of much of the weight by the use of links and coiled springs, for the potential friction involved is considerable.

As a result lubrication of the pitman bearing is of decided importance. Grease is usually the most generally adaptable lubricant, being applied to the bearing either by means of pressure lubricators or via reservoirs equipped with wool waste or some other form of pad retainer to insure positive lubrication without undue loss. Where pressure lubrication is employed a compression cup grease will usually be most adaptable. The use of wool waste or pad lubrication, however, will require a thinner grease, relatively fluid in consistency in order to enable proper penetration of the wool. In both instances the lubricant must be capable of reaching the lower wearing surfaces where pressure and friction will be the greatest. To more safely insure this, certain builders provide for delivery of grease under pressure to both top and bottom of the bearings.

Eccentric bearings likewise require positive lubrication with a suitable grade of grease. Unless the weight of the pitman is more or less balanced by springs, etc., its weight will be exerted upon the eccentric shaft bearings with the probable result that the lubricant will be unable to penetrate and maintain the requisite friction reducing film between the shaft and bearings. The construction of the crusher must therefore always be taken into consideration; where springs and links are used to balance the pitman, reservoir pad lubrication using liquid grease will probably work out satisfactorily. Where the weight of the pitman is exerted on the eccentric bearings, as well as on its own supports, pressure lubrication with a heavier grease will be more positive.

Toggle seats may or may not require lubrication, all according to the nature of their construction. Where rolling motion is provided for it is claimed that the need for lubrication is eliminated. Certain types, however, will involve sliding friction at the toggle seats. In such cases oil lubrication is usually provided for by the builders by means of suitable drip cups. For this purpose a relatively heavy machine oil will serve the purpose.

Gyratory Crushers

In the modern gyratory the matter of eccentric, gear, counter shaft and ball bearing (where installed) lubrication is a most important proposition. Automatic lubrication whereby the oil is circulated under pressure throughout these lower mechanisms is becoming practically standard on all such equipment due to the absolute necessity for continued and dependable maintenance of a sufficient flow of oil to not only withstand the pressures involved but also to remove any excess of heat developed.

This is brought about by means of a suitable oil pump which is located at the bottom of the crusher either within or adjacent to the oil reservoir or chamber in the bottom plate. An ample supply of oil is contained in the system, which as a rule includes a suitable filter or strainer through which the oil passes at each circulation. This, together with the general dust-proof construction of the modern gyratory, insures against the entry and circulation of an excess of dust through the system. As a result, all the lower wearing parts are served with a flood of clean, cool oil throughout the period of operation of the gyratry crusher, for by virtue of the nature of the design and construction the oil pump starts simultaneously with the latter, operating at a speed commensurate with the rate of crushing.

Under normal conditions of crushing, provided the system has an ample oil capacity, overheating will not usually present any difficulty. Where hard rock is to be crushed, however, during very hot weather, or in event of using too viscous an oil, it will be found advantageous to provide for cooling the oil during its circulation. The builders enable this on certain crushers by installing a water cooling coil in the oil chamber itself. Not only does this enable the cooling of used oil, but also it renders cold weather starting more feasible, for steam or hot water can likewise be circulated through such coils to warm up the oil.

For general warm weather lubrication of such equipment in systems as illustrated and discussed above, a straight mineral crusher oil of approximately 140 seconds Saybolt viscosity at 210 degrees F. will usually give the best results. In cold weather, however, it will always be advisable to resort to an oil of lower viscosity, especially to the burning room, will be supplied with three units, two of which will be ample to supply pulverized coal to the kilns as needed, allowing a third unit for reserve. The raw mill, finished mill, coal mill and burning room will be connected to the main storage. A 150,000 barrel storage will be built for the finished cement. This will be built of reinforced concrete of the conventional silo type. Fuller-Kinyon conveying equipment will be installed in this department.

An extra pack house will be located on the wharf, making it possible to market the entire production by either boat, truck or rail, as conditions may warrant.

Waste heat boiler equipment will be installed in connection with the kilns. This installation will be sufficient to furnish an excess of power and light for all the plant requirements. Power will be supplied by means of steam driven turbines of the latest improved type.

A commodious storeroom and machine shop will be located conveniently near the mill buildings. A laboratory equipped with the latest improved testing apparatus will be housed in a special building for that purpose, near to mill operations.

The plant will be entirely of steel and concrete construction. It is estimated that about one hundred seventy-five workmen will be employed. Because of the location of the plant within the corporate limits, complete dust proof equipment will be installed.

The Florida Portland Cement Co. has been organized with John L. Senior as its president. Mr. Senior has been identified with the cement industry for a number of years and is known for his success in cement plant operation. He is president of the Signal Mountain Portland Cement Co. at Chattanooga, the Peninsular Portland Cement Co. at Cement City, Mich., and is a director of the Peerless Portland Cement Co. with plants at Union City and Detroit, Michigan, and the Trinity Portland Cement Co. with plants at Fort Worth and Dallas, Texas. Associated with Mr. Senior as vice-presidents will be R. A. Drum, vice-president of the Cowham Engineering Co. of Chicago, and H. J. Weeks, assistant general manager of the Signal Mountain Portland Cement Co. of Chattanooga. R. N. Cowham, vice-president of the Peninsular Portland Cement Co. will be secretary and treasurer of the Florida Portland Cement Co. The other members of the Board of Directors will be:

J. L. Caldwell, president of the Tennessee Stove Works, Chattanooga, and vice-president of the Signal Mountain Portland Cement Co., Chattanooga; J. A. Griffin, president of the Exchange National Bank, Tampa; J. P. Hoskins, president of the First National Bank, Chattanooga, and treasurer of the Signal Mountain Portland Cement Co., Chattanooga; H. T. Lykes, Lykes Brothers, Tampa; H. C. Piper, of Lane, Piper and Jaffray, Investment Bankers, Minneapolis, Minn.; W. A. Sadd, president of the Chattanooga Savings Bank, Chattanooga, and chairman of the Board of Directors, Signal Mountain Portland Cement Co., Chattanooga; W. H. Wildes, of E. H. Rollins & Sons, Investment Bankers, Chicago.

The financing of the project will include a public offering soon to be made by the Cowham Engineering Co.

About $2,500,000 has already been subscribed by the organization syndicate and the remainder is being offered to the public. The public offering will be made on the basis of 7 per cent cumulative participating preferred stock, selling at par and carrying with it a bonus of a half share of common stock.

Work is progressing on the Ideal Cement Company's two million dollar plant at its site just above the city of Fort Collins, Colorado, in the natural gas field of northern Colorado.

Cement Stocks Increase in February

Figures on production, shipments and stocks of finished portland cement for the month of February, 1926, included in the monthly report by the Department of Commerce, Bureau of Mines, indicate a slight decrease in production, an increase in shipments and an increase in stocks on hand at the end of the month of February as compared with January, the preceding month. Production and shipments also show a decrease as compared with the same month of February last year.

Production for the month of February was 7,731,000 bbls., shipments amounted to 5,820,000 bbls. and stocks at the end of the month totaled 22,493,000 bbls.

This production was divided among the commercial districts as follows: Eastern Pennsylvania, New Jersey and Maryland, 2,447,000 bbls.; New York, 288,000 bbls.; Ohio, Western Pennsylvania and West Virginia, 739,000 bbls; Michigan, 288,000 bbls.; Wisconsin, Illinois, Indiana and Kentucky, 775,000 bbls.; Virginia, Tennessee, Alabama and Georgia, 1,029,000 bbls.; Eastern Missouri, Iowa, Minnesota and South Dakota, 483,000 bbls.; Western Missouri, Nebraska, Kansas and Oklahoma, 361,000 bbls.; Texas, 393,000 bbls.; Colorado and Utah, 67,000 bbls.; California, 743,000 bbls.; Oregon, Washington and Montana, 118,000 bbls.

The estimated clinker (unground cement) at the mills at the end of January, 1926, was 10,928,000 bbls.

Consumption

Production plus stocks at the beginning of the year plus imports minus exports and stocks at the end of the year indicate consumption of portland cement in the United States amounting to 147,477,000 bbls. in 1924, and 159,385,000 bbls. in 1925. This was at the rate of 1.32 bbls. and 1.40 bbls. per capita, respectively. The consumption, total and per capita, by states or other subdivisions can be approximated only, because the exchange of cement between states and actual quantities used in each state during a given year are not precisely known. The best available information comprises figures of shipments from mills into the various states.

During 1924, California lead the list of states with a per capital consumption of 2.73 bbls. and Michigan was second with a per capita consumption of 2.28 bbls. The minimum consumption in the same year was at the rate of 0.29 bbls. per capita in the state of Mississippi. In 1925, Florida lead with a per capita consumption of 3.24 bbls. and California was second with a per capita consumption of 3.06. Mississippi again had the minimum consumption in 1925 at 0.32 bbls. per capita.

Exports of hydraulic cement by countries in January, 1926, were as follows: to Canada, 971 bbls. valued at $4,720; to Central America, 10,901 bbls. valued at $28,840; to Cuba, 19,012 bbls. valued at $45,554; to other West Indies, 7,867 bbls. valued at $17,218; to Mexico, 5,615 bbls. valued at $18,385; to South America, 24,478 bbls. valued at $78,302; to other countries, 4,095 bbls. valued at $23,412; total for all countries, 72,939 bbls. valued at $216,431.

Imports from Belgium during the month of January, 1926, totaled 244,041 bbls. with a value of $370,162. Canada imported into Buffalo district, 161 bbls. valued at $602. Cuba imported into Florida 429 bbls. valued at $1,424. Denmark and Faroe Islands imported into Florida, New York and Porto Rico, a total of 82,129 bbls. valued at $146,692. Other importations from Japan, Norway and Soviet Russia in Europe brought the grand total of imports up to 360,580 bbls. valued at $576,717.

New Cement Plant for Buffalo

Great Lakes Portland Cement Corporation Starts Work on Plant to Produce Two Million Barrels of Cement Annually

Another new cement plant to be located in the Great Lakes region has been announced by the Great Lakes Portland Cement Corporation which company will proceed with the construction of a plant on the Union Canal between the Harbor Turnpike and the lake front at Buffalo, N. Y.

The company owns limestone deposits of approximately 2,000 acres at Rogers City, Mich., from which place the stone will be transported to Buffalo by lake freighters, and also owns 60 acres of shale deposits at Shaleton, N. Y. The Buffalo site which was purchased from the Pennsylvania Railroad Co., consists of 30 acres, of which 20 acres will be occupied by the cement mill. Test borings which preceded excavation for the mill buildings have been in process for several weeks.

Between 300 and 400 men will be engaged in the construction of the buildings which have been designed and will be supervised by the officers of the company who have had considerable experience in the construction and operation of portland cement mills in various parts of the country. A large part of the plant will be in operation in time for the 1927 building season and the mill will be fully completed by June or July of 1927, according to an announcement of the officials of the company.

The company has been incorporated for 60,000 no-par shares of common stock. The directors of the company are George A. Ball, Muncie, Ind., Seymour H. Knox, Buffalo, N. Y.; Adam L. Beck, Indianapolis, Ind.; M. H. Hammond, Indianapolis, Ind.; Marshall Beck, Indianapolis, Ind.; Fletcher M. Durbin, Chicago, Ill.; Paul M. Taylor, Huntington, Ind.; J. F. Schoellkopf, Jr., Buffalo, N. Y.; G. A. Tomlinson, Cleveland, O.; Bert B. Williams, Indianapolis, Ind.; and John H. Love, New York City. The officers who will be active in the company's management are: Adam L. Beck, president; M. H. Hammond, vice-president; Bert B. Williams, second vice-president; Marshall Beck, secretary and treasurer.

Offices of the company have been opened in the Marine Trust Company Building, Buffalo.

It is planned to produce 7,000 barrels of cement daily, or 2,000,000 barrels a year, this schedule to be reached in 18 months from the beginning of construction. A large amount of electric power will be used, 2,500,000 kilowatts being required each month, at the rate of 14 kilowatts per barrel of cement output.

Negotiations leading to the location of the new plant in Buffalo were begun with the industrial bureau of the Buffalo Chamber of Commerce last fall when Marshall Beck, secretary and treasurer of the company, conferred with the bureau on Buffalo's suitability for the location of a cement plant and the advantages of that city for the assembly of raw materials and for reaching the market with the cement produced. After investigating several different locations, Buffalo was chosen on account of its accessibility for the limestone brought down from Michigan, and the shale deposits just outside of Buffalo which could be assembled at the lake front. The cement can be shipped by rail, the Erie Canal and by motor truck, serving a territory within a radius of 200 miles from Buffalo.

Adam L. Beck, who is president of the new company, and M. H. Hammond, vice-president, recently sold the plant of the Indiana Portland Cement Company at Greencastle, Indiana, which they had built and operated. The Indiana plant was sold to the International Cement Corporation. Prior to their connection with the Indiana company, Mr. Beck and Mr. Hammond had been identified with the Oklahoma Portland Cement Co. in Oklahoma. Some time ago Mr. Hammond built a cement plant for the International Cement Corporation in Argentina.

Signal Mountain Portland Cement Co. Increases Capacity

More than $500,000 was spent during 1925 by the Signal Mountain Portland Cement Co., Chattanooga, Tenn., in increasing its annual production capacity from 1,000,000 to 1,500,000 barrels. The new equipment included one 11 ft. by 175 ft. rotary kiln, with an accompanying rotary cooler 8 ft. by 70 ft. Two new Allis-Chalmers compeb mills were installed in the raw department and two similar installations were made in the finishing department. All four of these mills were 7 ft. in diameter by 26 ft. in length, and are operated by 500 HP. synchronous motors.

One No. 6 Williams mill was also installed in the crushing department. This mill is served by a new 60-ft. rock elevator from the crusher.

Improvements during 1925 also included the extension of the main storage building 100 ft. long, increasing the capacity of the raw material storage by 15%. A new set of six silos for cement storage was also constructed, increasing the storage capacity by 100,000 barrels. A Fuller-Kinyon system was installed for conveying the finished cement.

Extensive developments were also conducted in the quarry. Several new quarry cars and other equipment were added.

Other improvements included a new office building at the plant site, garage and oil and motor repair storage.

The new improvements in construction were made by the Cowham Engineering Co. of Chicago, operators of the plant.

Northern Blower Co. Reports Increasing Business in the Cement Industry

Many cement plants are already making preparations for 1926 business, and are installing additional dust recovery equipment to meet the call for increased production and better material-recovery percentage methods, says Mr. Eiben, president of Northern Blower Co., Cleveland, Ohio.

Among other orders received by the Northern Blower Co. from the cement industry for their well-known Norblo dust-recovery and classifying units are the following.

Indiana Portland Cement Co., Greencastle, Ind. (continuous suction air-filter type Norblo unit for compeb mill dept.); Wabash Portland Cement Co., Osborne, Ohio (complete dust-handling equipment for all departments, including units of the cloth screen and the continuous suction air-filter types); the Rich Lime Co., Swanton, Vt. (continuous suction air-filters); and the Michigan State Industry Cement Plant (cloth screen and continuous suction air-filter type Norblo units).

Mr. Eiben, commenting on the nature of the equipment specified, is of the opinion that 1926 will see a steadily-growing interest in the cement industry in higher efficiency in waste material recovery, the elimination of losses through suspended dust, and the utilization of recovered lime and cement as a profitable by-product.

Three Live Steam Topics

By W. F. SCHAPHORST, M. E.

Steam Flow Meter Advantages

It is often learned after installing steam flow meters that entirely too much steam is used in certain departments of the plant. Faults are thereby corrected and the meter pays for itself almost instantly. Without meters the existence of large and costly leaks cannot be easily detected.

Paradoxical as it may sound, many times it has been found profitable to install a steam flow meter only to learn that it doesn't pay to use steam at all. Thus if a plant is consuming considerable steam in one department and the manager is not certain about the profitableness of the steam, a meter should be installed. The meter will give the facts. Then, if the meter shows positively the electrical operation would be better than steam the use of steam should be abandoned and electrical equipment installed in its place. Although by so doing the steam flow meter eliminates its own use it is nevertheless good business and good engineering to do so.

Roughly, every six pounds of steam wasted is equivalent to one pound of coal wasted, plus the cost of production of the steam. Save the steam and you save coal, labor, and equipment. Even where fuel is cheap it is poor business to install more boilers and use more firemen than necessary. It invariably pays to know where every pound of steam goes and how economically it is used.

Forced draft, chain grate stokers, underfeed stokers, oil burners, powdered fuel, higher pressures, superheat, combustion arches, CO_2 and CO meters, air preheaters, economizers—all of these improvements have contributed admirably to the cheaper production of steam. But, if no check is kept on the consumption of the steam after it leaves the boilers, if the steam is wastefully used, of what value are the improvements? If all of the steam is wasted it is evident that the improvements are of no value whatever. If no steam is wasted the full advantages of the improvements are realized, and only then. We can therefore truly say that the advantage of high boiler efficiency is directly proportional to the economy of steam used.

Surely, with all the effort and engineering ability that is being and has been expended on boiler plants to generate more steam per pound of coal serious attention should be given to the uses of the steam. Flow meters are the best means of collecting data for an accounting system applied to a boiler plant.

Quantity of Steam

It is an easy matter to estimate the quantity of steam flowing out of a boiler or steam pipe into the open air, or from a high pressure pipe to a low pressure pipe. For instance, one may wish to know the approximate amount of steam used for creating draft or for blowing soot, etc.

Simply multiply the gauge pressure in lb. per sq. in. by the area of the steam opening in sq. in. and then by .0143. The result will be the weight of steam in pounds flowing through the area per second.

Probably the reader would prefer to figure the cost of the steam. If so, here is a good rule: Multiply the gauge pressure in lb. per sq. in. by the area of the steam opening in sq. in., then by the cost of fuel in dollars per ton of 2000 lb., then by 0.257 and lastly divide by the number of pounds of water evaporated into steam in the boiler or boilers per pound of fuel. The result will be the cost of steam in dollars per 10-hour day.

As an example, what is the cost of steam per day flowing through a half-inch opening for creating draft in a furnace where the gauge pressure is 140 lb. per sq. in., fuel costs $8.00 per ton, and 8.5 pounds of water are evaporated per pound of fuel?

Look into your table giving areas of circles, or compute it, and the area of a half-inch circle will be found to be 0.196 sq. in. Then, applying the above rule it will be determined that the cost is $6.64 per 10-hour day.

Will Steam Superheat?

The writer has often heard this question asked: "Will steam superheat in passing through a reducing valve? There are two answers:

First: Yes, steam will superheat in passing through a reducing valve if the steam at 100 pounds pressuse is dry saturated. That is, if it does not contain any moisture.

Second: It will not superheat if it contains more moisture than 1.26%.

The reason why this is true is that steam at various pressures contains various quantities of heat. Thus, at 100 lbs., gauge 1 lb. of steam contains 1190.7 heat units; whereas at 45 lbs. gauge it contains 1179.1 heat units. If the steam is perfectly dry before entering a reducing valve we have a difference of 11.6 B.t.u. (1190.7-1179.1) to take care of, and since heat cannot be lost it will be utilized in superheating the steam.

The specific heat of superheated steam is about 0.47. Knowing this we can compute the degree of superheat by dividing 11.6 by .47, which gives us 24.7 degress. That is, the steam will have a temperature of 24.7 degrees higher than the ordinary temperature of dry saturated steam at a pressure of 45 lbs. gauge. Our steam tables show us that the temperature of unsuperheated steam at 45 lbs. gauge is about 292.7 degrees Fahr. Adding 24.7 degrees to this we get 317.4 degrees as the temperature of the steam after passing through the reducing valve provided it is absolutely dry before entering the valve.

To determine the percentage of moisture allowable in the steam so that as it emerges from the reducing valve it will be "just dry" we find in our steam table that 917.4 heat units are required to evaporate 1 lb. of water at 45 lbs. gauge. This being the case, and since we have a surplus of 11.6 heat units, by dividing 11.6 by 917.4 we get .0126. In other words, 11.6 heat units are sufficient to evaporate .0126 lbs. of water, which is equivalent to 1.26% of 1 lb. Therefore, the maximum allowable amount of moisture is 1.26%.

Does Dressing Weaken Belt Joints?

Some belt men seem to believe that if an oily belt dressing is used on a leather belt and if it is allowed to penetrate the leather the cemented joints will suffer.

Joints of this kind often open up, that is true, and they cause belts to break, sometimes causing shutdowns for repairs; but it is not due to the belt dressing alone.

This point has been investigated with considerable care and it has been learned that excessive lubricant or dressing will not cause a belt joint to open up unless the belt has been mistreated at the start. If the belt is allowed to become dry, it will naturally harden and stiffen. Then, in passing around the pulleys the hardened leather in the neighborhood of the joint creates a sort of grinding action on the cement. The cement is broken and partially pulverized. Space is thus formed in the joint seams into which the lubricant will penetrate if too much is used, and we are then confronted with the danger of the joint opening up and pulling apart.

Dress a belt with a good dressing at the time it is installed and maintain it in a properly pliable condition, and there will be no danger of the cement breaking into bits. The joint will not pull apart.

Does Pulverized Coal Pay?

By W. F. SCHAPHORST, M. E.

According to comparative tests made in a large power plant pulverized coal is more efficient than stoker fired coal by about 4%.

It should be remembered, however, that the cost of pulverizing the coal and the cost of more expensive handling must be considered and must be paid for out of this 4% increase in efficiency, a feat that the writer considers doubtful in the face of the following statement that recently appeared in a prominent publication:

"The cost of grinding and distributing equipment—under average conditions, amounts to 15 to 20% of the fuel cost. Sometimes it is less, but in many cases it is considerably more."

Probably the above question referred to a cheap grade of coal in which case efficiency is of less importance than making the coal burn and produce heat. One of the great advantages of powdered coal is that it enables consumers to utilize mine sweepings and coal dust which are practically unburnable on grates.

In general it is safe to say that the first cost of pulverized coal apparatus is about the same as the first cost of stoking apparatus. Sometimes stoker firing is preferable and sometimes powdered coal. Conditions are seldom exactly alike in any two plants, consequently all plants should be individually studied before deciding upon the mode of firing. At any rate it is not likely that it will ever pay to change from stoker firing to powdered coal in old plants because of the fact that even in new plants the advantage of powdered fuel is often doubtful.

Where a uniform grade of coal is unobtainable pulverization reduces all grades and kinds to a uniform burnable size and therein lies one of its greatest advantages.

Portland Cement and Magnesia

By DR. ING. OTTO MERINSKY

Vienna School of Technology

Portland cement is made by firing natural chalky marl or artificial mixtures of clay and lime containing substances to the sintering point, but it has not been definitely determined yet what role is to be ascribed to the magnesia in portland cement.

Although raw materials rich in magnesia are ordinarily avoided, it was found that magnesia portland cement frequently is equivalent to the best portland cements, and in other instances again it is vastly inferior. If magnesia holding raw materials only are available for the manufacture the process has to be altered accordingly. Out of his wide experience in this field Dr. K. Balthasar, in an article in the *Tonindustrie Zeitung*, says:

If we call $\frac{CaO}{SiO_2+R_2O_3}$ the hydraulic modulus, the raw mixture should be made according to the hydraulic modulus=2.10. $\frac{CaCo_3+Mg\ CO_3}{CaCo_3}$ is called the Dolomite modulus. $(CaCO_3+Mg\ CO_3)$ defines the determination of the total carbonic acid transfigured to carbonate of lime, which determination should be checked hourly. $CaCO_3$ is the actual content in carbonate of lime.

The firing of the magnesia portland cement should not stop at the sinter point, but the burnt bricks should be kept at the melting point for considerable time.

During the firing, after the raw mass is dried out and the carbonic acid expelled, first a yellow substance is formed, which if ground is equal to a good grade of Roman cement. Later a clinker is formed which decomposes after a few days in the air. The ground clinker has no hydraulic properties and turns to a blue-black color.

In order to obtain the final product this has to be fired in a pit kiln double as long as ordinary portland cement.

The average properties of magnesia portland cement are:

Color—Light gray;
Spec. grav.—3.1;
Weight per liter—Loose, 1250 g; shaken down, 1900 g;
Binding time—Start 8 hours, complete 12 hours;
Temperature of air and mixing water—18° Celsius;
Temperature increase during binding—2° Celsius;
Constancy of volume—in air—constant
in water—constant
baking and boiling—constant;
Hardness with sand—1.3;
Tensile strength—after 3 days, 18 k.g. per sq. cm.; after 7 days, 27 k.g. per sq. cm.; after 28 days, 32 k.g. per sq. cm.
Pressure resistance—at 3 days, 160 k.g. per sq. cm.; at 7 days, 250 k.g. per sq. cm.; at 28 days, 300 k.g. per sq. cm.

A Census of Distribution Proposed

A census of distribution may be an accomplished fact by 1930. As the first step towards its establishment, Secretary of Commerce Hoover now is considering a plan to include in the next biennial census of manufactures schedules asking from one or two industries not only for production data but for similarly complete information on sales and stocks. The 1925 census of manufactures already is under way, so the experimental schedules designed to determine the feasibility of a census of manufactures under the plan now being studied by Mr. Hoover. Alvin E. Dodd and Theodore F. Whitmarsh, U. S. Chamber of Commerce officials who were active in the national distribution conference which advocated a census of distribution to supplement the biennial census of manufactures, discussed the new plan with Secretary Hoover this week.

The proposal for a trial census of distribution covering only a few industries still is tentative, Secretary Hoover stated when asked to comment on the plan. It has not yet been discussed with William M. Steuart, director of the Census Bureau, who is confined to a hospital as a result of an automobile accident. Legislative authorization from Congress is necessary to carry the plan forward, but it appears that, after several years' discussion, an actual plan looking towards establishment of a census of distribution will be formulated. If the trial census taken in 1928 and covering the 1927 operations of the industries selected for the test is regarded as successful, Secretary Hoover said that a complete census of distribution may be taken along with the usual decennial census of manufactures in 1930.

An eastern syndicate has purchased 300 acres of land near Pride Station, Ala., in the Muscle Shoals district, and it is reported in Birmingham that they will build a large cement mill, costing $1,000,000 on this property. According to the report work will commence on this plant within the next sixty days.

That section of Colbert County, Alabama, where this property is situated, is rich in deposits of cement rock. The land purchased by this syndicate is said to contain sufficient cement rock to keep the plant running many years.

Geology of Jackson County, Missouri

With Particular Reference to the Strata Used in the Manufacture of Portland Cement

By P. F. BALFOUR

> It has been suggested by a chemist who has visited most of the cement plants in the United States and Canada that at many plants the chemist has little knowledge of the geological formation his plant is using as raw material, and that a survey of these plants to find the geological name, fossils occurring, and extent of the rock or shale used would be of interest.
>
> An excellent government bulletin on this subject, issued several years ago is now out of print and a number of plants have started operating that could add much of interest, particularly in new locations. Many changes have taken place in the last decade, many new mills having been started for the manufacture of cement from materials differing widely in geological horizon and similar only in their chemical composition.
>
> The following article, it is hoped, will stimulate interest in the subject, and will result in further studies and reports.—Editors.

In regard to importance of population and wealth. Jackson County is second in the state of Missouri. It is bounded on the west by the state of Kansas and on the north by the Missouri River.

The surface is considerably broken, but except when the ledges of rock outcrop the soil is deep and very fertile. Along the Missouri River the bluffs are at places between 250 and 275 feet above the river level. On top of these bluffs the soil is known as Loess. It is supposed to have been a wind deposit of the Pleistocene Age. Its average depth is 16 ft. to a distance of three miles south of the river and then thins out to nothing in the next mile or two. It is light brown in color and has the property of maintaining a vertical wall for its full depth. On chemical analysis it shows 75% silica, 12% alumina, 3% iron oxides and less than 2% magnesia, potash and soda. It is well adapted for fruit trees, alfalfa and cereals.

Farther from the river the surface soils become clays and loam and outside of the local creek bottoms the surface approaches that of the prairie at the southern limits.

The Missouri River has an average slope of 0.80 ft. per mile from Bismarck, N. D., to St. Louis, Mo. At the northwest corner of Jackson County low water level, Kansas City datum 0.0 is 723.492 ft. above sea level. The highest land in the county is 1077 ft. so the distance from the highest point to the lowest is 353.6 ft.

The consolidated rocks outcropping in the county belong to the Pennsylvania series of the Carboniferous Era in Paleozoic time. Only the five lower formations of the series outcrop.

The average depth of sedimentary rocks over the county is 2350 ft. This is determined from several wells sunk to the granite "fundamental basement."

Below is the record of a diamond drill hole near center of county:

Total	2348 ft.
Pennsylvanian	752 ft.
Mississippian	448 ft.
Ordivician	121 ft.
Cambro-Ordivician	779 ft.
Cambrian	248 ft.
Total	2348 ft.

The Pennsylvanian rocks appearing above low water level of the Missouri River are as follows:

Lansing Formation	Plattsburg Limestone	7 ft.	
	Lane Shale (sandy, containing three thin beds of Limestone)	58 ft.	65 ft.
Kansas City Formation	Iola Limestone	43 ft.	
	Chanute Shales (bearing Raytown Limestones, 6 ft., and Cement City Limestones, 8 ft.)	65 ft.	
	Drum Limestone	9 ft.	
	Cherryvale Shales (bearing 2 thin layers of Limestone)	26 ft.	
	Winterset Limestone (bearing 3 thin shales)	29 ft.	
	Galesburg Shales	4 ft.	
	Bethany Falls Limestone	23 ft.	
	Ladore Shales (bearing 2 layers of Limestone)	11 ft.	
	Hertha Limestone	11 ft.	215 ft.
Pleasanton Formation	Shale with thin bed of Coal	165 ft.	165 ft.
Henrietta Formation	Limestone	8 ft.	
	Slaty Shale	11 ft.	
	Limestone	4 ft.	
	Slate	10 ft.	
	Coal	1 ft. 6 in.	
	Fireclay	5 ft. 8 in.	
	Limestone	5 ft. 0 in.	
	Slaty Shale	14 ft. 2 in.	
	Limestone	4 ft. 3 in.	45 ft.
Cherokee Formation	Limestones Slates Coals Sandstones	435 ft.	435 ft.
	Total		925 ft.

Only a portion of the top layers of the Cherokee appears in Jackson County.

Quarries

Most of the commercial rock in Kansas City is up to present time produced from a score of open quarries working in the Winterset and Bethany Falls layers. In all cases they have overburden and also the Galesburg shales to handle as waste.

Some building rock is obtained from the Raytown and Cement City limestones of the Chanute shales.

In a few cases the Iola limestone is quarried.

In one case the Hertha is quarried.

Portland Cement

The Missouri Portland Cement Co. operates the only cement plant in the county. It is located at Cement City, on the south bank of the Missouri River, ten miles down stream from Kansas City.

Since the plant was built about 17 years ago, nearly every shale and limestone of the Kansas City formation has been used for raw material in making cement. During the past 15 years the rocks and shales have been tunneled and during that period the members of the formation used have been limited to the lower 7 ft. of the Winterset limestone, the Galesburg shales and the Bethany Falls limestone. From top to bottom the average sections give the proper proportions of limestone and shale for making cement. Until comparatively recently it was a difficult task to make the mix constant, but with the building of a 10,000 ton blending storage bin the difficulty is eliminated.

Bureau of Standards Studies Properties of Gypsum

In reviewing the literature on the process of manufacture of calcined gypsum it is found that while the various steps used in its manufacture have been studied in detail from a mechanical standpoint, little effort has been made to correlate the variations in the product with the different methods used and the impurities which sometimes naturally occur. With this in mind a study has been made at the Bureau of Standards of the effect of the fineness of the gypsum, the temperature of calcination, and the effect of some materials in the raw gypsum on the properties of the calcined product. Three different sizes of materials were calcined to four different temperatures, while one size was calcined with seven different impurities, and the properties of the products studied. The properties investigated were composition, tensile strength, fineness, time of set, and plasticity. As only two of the impurities that were used gave deleterious results in the amounts employed, the percentage of each was decreased until the resulting product was approximately the same as the one in which no impurity was present.

In view of the results obtained, the following conclusions seem to be justified:

1. Raw gypsum passing a No. 100 and retained on a No. 200 sieve calcines more readily than does coarser or finer gypsum.
2. In general, the tensile strength of 1:3 gypsum-sand mixes is increased with increase of the time and temperature of calcination of the gypsum and fineness of the calcined gypsum.
3. The plasticity of 1:3 gypsum-sanded mixes is increased by increased fineness of the gypsum, and by increased semihydrate content, and is decreased by the presence of artificial anhydrite.
4. The time of set of calcined gypsum is lengthened by an increase in the degree of calcination.
5. Of the various impurities studied only sodium chloride and sodium sulphate are deleterious when present in the raw gypsum, although silica does lower the tensile strength.
6. The sodium chloride content of gypsum should be less than 0.15 per cent in order to escape deleterious effects on the properties studied.
7. The sodium sulphate content of gypsum should be less than 0.5 per cent in order to escape deleterious effects on the properties studied.
8. The impurities studied all lower the plasticity of 1:3 gypsum-sand mixes.
9. Sodium chloride when present in raw gypsum seems to convert the gypsum during calcination, into an anhydrous sulphate, which does not appear to revert to the dihydrate on the addition of water.

A 24-page, royal blue publication, approximately 11x8¼ in., and numbered "145," has been received from the *Milwaukee Locomotive Manufacturing Co.*, Milwaukee, Wis. Some two dozen photographs illustrate the product clearly and in detail, followed by condensed specifications on each type of locomotive, from the 4½ to the very recent 18 and 20 ton additions to the Type "H."

Second Dust Arrester System to Be Installed at Michigan State Industries, Chelsea, Mich.

The Michigan State Industries cement plant at Chelsea, Mich., is about to install a second Norblo dust-arresting system. The first units of this system were installed some months ago by the manufacturers, Northern Blower Co., Cleveland, Ohio.

This second set of units, which will shortly be shipped from the factory, are Norblo dust-arresters of the cloth screen type, and they are to be used for removing and recovering suspended dust from the bagging, packing and storage department of the plant.

The method of recovery adopted in this type of equipment consists of drawing the air over hoppers to remove the heavier particles and then passing it through closely-woven cloth screens to catch the finer dust. A rapping device serves to clean the screens every few hours from the accumulation of dust which would otherwise decrease the efficiency of working. Special Norblo slow-speed fans are used to create the necessary exhaust, and since they are placed on the exhaust side of the screens they cannot be damaged or worn by contact with the suspended matter. The test efficiency is stated to be over 99% recovery percentage.

Davenport Adds to Locomotive Line

A full new line of gasoline locomotives of the gear drive type, ranging in size from 8 to 20 tons, is announced by the Davenport Locomotive Works, Davenport, Iowa.

In these locomotives geared transmission replaces the roller chain transmission and individual wheel drive of the present Davenport gasoline locomotives, although the manufacture of the original type will also be continued.

Many new features of design and construction have been incorporated, among which is a three point suspension principle with cross equalizer to give improved tracking qualities. A fully enclosed, roomy, all steel cab is provided for comfort and convenience in operation.

Many mechanical features have been incorporated which are noteworthy. The master clutch is a step jaw clutch which is always halfway in when the faces are engaged, which, it is claimed, eliminates the possibility of chipped corners on the clutch faces. Reduced clearance is also made possible by this construction which reduces backlash.

Powerful Climax engines are used—6 cylinders in the 16 and 20-ton sizes and 4 in the 8 and 12—with four speeds forward and four reverse.

The addition of this new line, together with the 4-ton Fordson-Davenport recently announced, makes the gasoline locomotive line of this company highly complete.

New Cement Enterprise in England

Speaking at the statutory meeting of the Halborough Cement Co. in London, recently, the chairman, Major W. L. H. Roberts, said that their issue in October was considerably over-subscribed. The property purchased contained raw materials acknowledged to be the finest in the country. Two kilns were working and the third would be ready soon. It was expected that the suggested output of 125,000 tons per annum would be fulfilled. He emphasized the excellent transport and disposal facilities at the Medway site. Far from experiencing any difficulty in disposal, said the speaker, they were at times only able to supply a fraction of demands. A progressive future was anticipated and all the estimates published in the prospectus were expected to be fulfilled or even exceeded.

Men and Mills

Notes from the Field

Construction of the new plant of the Louisiana Portland Cement Co. at New Orleans, La., is progressing rapidly, several contracts having been let recently. The very satisfactory weather conditions that are being experienced at the present time are being taken advantage of and construction work pushed.

The Louisiana Portland Cement Co. is one of the subsidiaries of the International Cement Corporation, producers of the "Lone Star" brand of Portland cement. A. D. Stancliff is superintendent of the Louisiana company.

Two hundred tons of clay is being shipped daily from the new clay pits of the New Egyptian Portland Cement Co. on the outskirts of the village of Smiths Creek, Mich., according to a report from Port Huron, attributed to John A. Acker, manager of the Port Huron plant of the company.

Two dragline machines, each capable of digging 1,000 feet of clay every 10 hours are now in operation and a railroad siding has been laid from the Grand Trunk railroad to the pits. The property was purchased by the cement company last year and it is estimated that it contains a sufficient supply of clay to provide for the needs of the company for a number of years.

All of the clay taken from the pits is consumed by the two plants of the New Egyptian company, two-thirds of it being shipped to Port Huron and the remaining third to the company's Fenton plant. The company is contemplating adding a new machine with a capacity double that of the present dragline machines.

H. C. Osman, sales manager of the Nugent Steel Castings Co., Chicago, Ill., has been elected secretary of the company. He will continue to have charge of the sales for the company.

C. A. MacDonald, formerly secretary has been elected treasurer.

Thorne L. Wheeler of Arthur D. Little, Inc., has been appointed by General Amos A. Fries as one of the consultants for the Chemical Warfare Service. Mr. Wheeler is a specialist in the Activation of carbons, which are used for gas masks.

The Cutler-Hammer Mfg. Co., of Milwaukee, Wis., has opened a new sales office in the Healey Building, Atlanta, Georgia. This office will take care of the trade in the states of North Carolina, South Carolina, the eastern section of Tennessee, Georgia, Florida, Southern Alabama, and Mississippi. A. C. Gibson, formerly of the Philadelphia office, is in charge.

The General Machinery Co. of Birmingham, Alabama, will continue to serve their trade in the northern half of Alabama.

J. E. Zahn, general manager United States Portland Cement Co. serves on a number of committees during the year, and the latest one is that to look into the advisability of the Denver Chamber of Commerce lending its aid to boost a new railroad from Craig, Colorado to Provo, Utah.

The Hercules Cement Corporation has recently removed its offices to 1700 Walnut St., Philadelphia, Pa.

Concrete mills in the Birmingham, Ala., district and at other points in that state are operating at capacity and are finding a ready market for their product. Much cement is being used all over Alabama and in many parts of the south in the construction of concrete roads and streets. In Birmingham, Ala., and other Alabama cities much concrete is going into buildings at this time. Birmingham mills are shipping much cement to Miami and other boom centers in the state of Florida.

The Arkansas Railroad Commission issued an order March 10, reopening its investigation of interstate freight rates on cement, sash weights, nails, composition roofing and composition shingles, it is reported from Little Rock. The petition for the investigation was filed by the Pine Bluff Chamber of Commerce for the Standard Lumber Company some time ago and on Feb. 15 the commission made an order fixing rates on these commodities, effective March 15.

In the order reopening the case the previous date was cancelled pending further hearing before the commission and the case was set down for a second hearing on March 23, at the railroad commission offices in the state capitol.

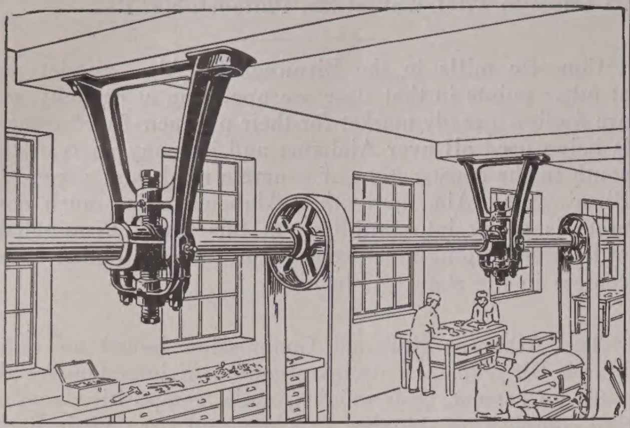
Trade Publications

A convenient chart for the use of engineers who have occasion to calculate quantities connected with the expansion of steam is being distributed by the De Laval Steam Turbine Co., of Trenton, N. J. The well known Mollier diagram is printed upon a stiff sheet of Bristol board, attached to which is a scale which can be broken off and used directly for measuring heat available, spouting velocity, pounds of steam per horsepower hour and duty between given pressure limits on the entropy diagram; that is, the chart and scale give these quantities directly for a perfect heat motor. If the steam consumption of an actual engine or turbine is known, the efficiency ratio is found by a simple division. The quality of the steam at the end of a perfect expansion or at the end of actual expansion of known efficiency or steam consumption is also read off immediately from the chart. Copies will be sent upon request.

A line of speed reducers for use with standard or high speed motors driving slow or moderate speed machinery, including worm reduction gears of the horizontal and vertical shaft and double reduction types, also helical gears for low ratios, and double helical gears for high power service, are described in a 16-page booklet published by the De Laval Steam Turbine Co., of Trenton, N. J. The illustrations include many colored views, which clearly set forth the details of construction, materials used, the pressure oiling system for heavy duty service, etc.

Pit and Quarry Handbook, 1926, published by the Complete Service Publishing Company, 538 S. Clark St., Chicago, is a newer and better version of the instructive handbook published every year by that concern. This 576 page book is divided into thirty sections, each written by an authority. These sections cover such topics as Geology, Clinker Handling, Accident Prevention, Crushing, Grinding, Pulverizing, Elevating and Conveying, Storing and Miscellaneous Handling, Burning, Waste Heat Recovery, Stripping, Loading, Transporting, Dredging, Pumping, Hydraulic Stripping, Power Transmission, Power Plant Operation, Powdered Coal, Screening and Separating, Washing and Drying, Hydration of Lime, Lubrication, Drilling and Blasting, and many other things of interest. Each section is followed by a few catalogue pages showing equipment mentioned in the section. This book is published primarily for use by producers of sand, crushed stone, gravel, lime, gypsum, cement and other non-metallic minerals.

The American Society for Testing Materials announces through its bulletin that Committee C-11, on gypsum products, with the aid of the Bureau of Mines, is continuing its work on investigations dealing with the possible use of gypsum-anhydrite mixtures in the manufacture of Portland cement, for the purpose of retarding the time of set.



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Faithful, enduring, that hanger overhead gives continuous, uninterrupted service, requiring a minimum of attention.

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Cast Iron Hangers and Pulleys, Flexible Couplings, Friction Clutches, U. G. Short Center Contactors—a complete line of Power Transmission Appliances.

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You will find a welcome in Booth 415 at the International Textile Exposition and Boston Power Show, Boston, April 12-17.

Across-the-Line Starters Easily Accessible

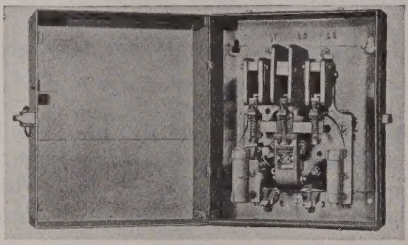
The Westinghouse Electric and Manufacturing Co. is manufacturing two new types of across-the-line starters, the reversing and the non-reversing type, that are neat and compact in design, and are easily accessible for installing and wiring. Two slotted hexagonal screws firmly hold the starter unit in place in a sheet steel cabinet. Thus the starter may be taken out as a unit, by merely removing these two screws with an ordinary screw driver, leaving all the room inside the cabinet for attaching conduit bushings and drawing in the leads.

The starter, consisting of a 3-pole contactor with electrical interlock, is completely enclosed and is operated entirely from a push button station located conveniently. In this way it provides safe control and eliminates damage which may be caused by tampering, or by unskilled handling. In addition to this safety feature, a floating armature type, three-pole contractor is used that provides smooth and positive contact. It is quiet in operation and the contactors tips are kept clean by the rolling and wiping action in closing, thus preventing the tendency to heat or weld under load.

Where the operating conditions necessitate the protection of the starter against an accumulation of chips or other foreign matter, a door interlock may be had that makes it impossible to start the motor unless the cabinet door is fully closed.

The non-reversing starters, class 11-160, are applicable for use in textile mills, on machine tools such as lathes, boring mills, grinders and cutters; also for wood-working machinery, conveyors, blowers, and pumps.

The reversing type, class 11-165, is of the same sturdy and safe construction and has the same essential operating characteristics as the non-reversing type, in addition to a mechanical interlock which makes it impossible for both contactors to close at the same time. This type is used advantageously on turret lathes, machine tools, on lift gates and on window sashes.



Non-reversing type, starter removed as a unit from cover

Trade Publications

The Electric Controller & Mfg. Co., Cleveland, O., has just issued its first leaflet on the use and methods of installing E C & M separator magnets. The leaflet is letter size and consists of four pages of descriptive matter and illustrations. Among the illustrations are those showing this equipment installed at the head of a crushed coal conveyor, above a crushed stone conveyor, and hung from a pivoted jib over a conveyor in a cement mill. The title of the leaflet is *E C & M Separator Magnets.*

Florida, Its Industrial Possibilities is a 24-page booklet 4x6¼ inches, issued by the Cowham Engineering Co., Chicago, Ill., to acquaint the reader with the industrial influences at work in that state, after more than a year of careful study, analyzing its possibilities as a future market.

It is set forth that new industries have grown up in the wake of the construction advance in Florida, and that great demands have been made on. the manufacturers of structural steel, Portland cement, lumber, brick, machinery, hardware and electrical equipment.